Front-side Type II Radio Bursts without Shocks near Earth

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Type II radio bursts are due to shocks driven by coronal mass ejections (CMEs), so the shocks are expected to arrive at Earth in 2-3 days if the source is on the front-side of the Sun. However, a significant fraction of front-side CMEs producing type II bursts did not result in shocks at 1 AU. On can think of several possibilities for the lack of shocks: (1) CMEs originating at large central meridian distances may be driving a shock, but the shock may not be extended sufficiently to reach to the Sun-Earth line. (2) CME cannibalism results in the merger of shocks so that one observes a single shock at Earth even though there are two type II bursts near the Sun. (3) CME-driven shocks may become weak and dissipate before reaching 1 AU. We examined a set of 30 type II bursts observed by the Wind/WAVES experiment that had the solar sources very close to the disk center (within a CMD of 15 degrees), but did not have shock at Earth. We find that the near-Sun speeds of the associated CMEs average to ~600 km/s, only slightly higher than the average speed of CMEs associated with radio-quiet shocks. However, the fraction of halo CMEs is only ~28%, compared to 40% for radio-quiet shocks and 72% for all radio-loud shocks. We conclude that the disk-center radio loud CMEs with no shocks at 1 AU are generally of lower energy and they drive shocks only close to the Sun.